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Review of the Genus *Odontodactylus* (Crustacea: Stomatopoda)

By Raymond B. Manning
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The genus *Odontodactylus* was proposed by Bigelow (1893) as a subgenus of *Gonodactylus*, from which the former differed in having the dactylus of the raptorial claw armed with teeth. *Odontodactylus* was recognized subsequently as a full genus by Bigelow (1894).

Representatives of the genus are most abundant in the Indo-West Pacific region, but one species is known to occur in the Atlantic. Comparison of a series of *O. havanensis* from the Atlantic with specimens of *O. brevirostris* from the Indo-West Pacific in connection with a revision of the western Atlantic stomatopods suggested that the specimens were conspecific. The comparative study further suggested that some characters previously used for species recognition in the genus were unreliable and that other characters might be of more value.

The current study shows that *Odontodactylus* contains five species, of which one described herein is new.

METHODS.—The terminology of the carinae of the telson in *Odontodactylus* used herein is shown in figure 1. There are some differences between these terms and those proposed by Kemp (1913). The latter are somewhat confusing in that the anterior extension of the carina of the submedian marginal tooth is called the "intermediate";

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the carina of the intermediate tooth is called the "first lateral"; and the carina of the lateral tooth is called the "lateral carina." In the present study the carinae of the marginal teeth are named for the tooth on which they occur. Thus the carina of the submedian tooth and its anterior extension are referred to as the "submedian." In *Odontodactylus* there may be one or two carinae between the median and each submedian carina; these are referred to as the "accessory median carinae." The accessory median carinae are unique to certain species of *Odontodactylus;* species in other genera, including *Pseudosquilla* Dana and *Pseudosquillopsis* Serène, have no more than one accessory median carina on each side of the median carina.

Measurements are given in millimeters. Total length (TL) is measured on the midline, from the anterior margin of the rostral plate to the apices of the submedian teeth of the telson; in the section on material, the number appearing after the number of specimens is total length. Carapace length (CL) is measured on the midline and does not include the rostral plate. The eyes of *Odontodactylus* are subglobular, with the cornea divided longitudinally by a distinct band of ocelli. Cornea length is measured along this band, cornea width across it. The width of the abdomen is measured at the fifth abdominal somite. Telson width is the greatest width; telson length is the distance on the midline from the anterior margin of the telson to the bases of the movable apices of the submedian marginal teeth. Segments of the uropodal exopod are measured along their midline.

The corneal index (CI) is obtained by dividing the carapace length by the cornea width and multiplying by 100. The abdominal width-carapace length index (AWCLI), an expression of the relative width of the body, is obtained by dividing the carapace length by the abdomen width and multiplying by 100. The relation of the lengths of the two segments of the uropodal exopod is given as the ratio obtained by dividing the length of the proximal segment by the length of the distal. In *O. cultrifer* the relative height of the median carina of the telson in males and females is expressed as the ratio of the height of the median carina to the width of the telson.

The synonymies given herein include original references as well as references published subsequent to the work of Kemp (1913). Additional older references will be provided in a synonymy of the Stomatopoda to be published in "Crustaceorum Catalogus" by L. B. Holthuis.

Most abbreviations for repositories are given in the acknowledgments below. The following abbreviations are also used in the text: AM (Australian Museum, Sydney); BLIH (Biological Laboratory of the Imperial Household of His Majesty, The Emperor of Japan). Collections from these two sources have been discussed elsewhere (Manning, 1965, 1966).

ACKNOWLEDGMENTS.—I would like to thank John Field, University of Cape Town, South Africa (UCT), for the loan of specimens; J. Forest, Muséum National d'Histoire Naturelle, Paris (MNHNP), for providing working space; C. B. Goodhart, University Museum of Zoology, Cambridge (UMZ), for allowing me to examine on loan the types of *O. latirostris* Borradaile; L. B. Holthuis, Rijksmuseum van Natuurlijke Historie, Leiden (RMNH), for his advice, help on literature, and for providing working space as well as specimens on loan; R. W. Ingle, British Museum (Natural History) (BMNH), for providing working space, specimens on loan, and information on the collection of *Odontodactylus* in the British Museum; J. Stock, Zoological Museum, Amsterdam (ZMA), for working space and for the loan of part of the *Siboga* collection; and T. Wolff, Universitets Zoologiske Museum, Copenhagen (UZM), for the loan of several specimens. This study was supported in part by the National Science Foundation and the Smithsonian Institution through its Research Awards program; this support is gratefully acknowledged. The illustrations are from the pen of my wife Lilly.

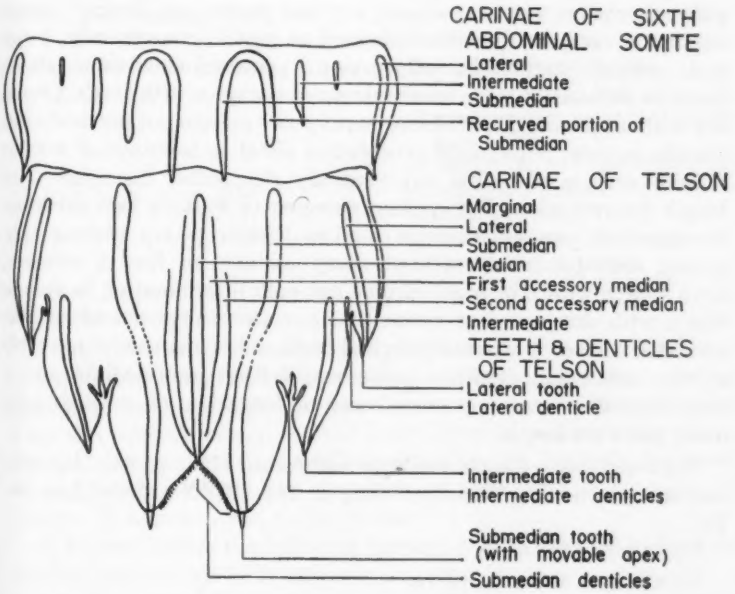

FIGURE 1.—Representative *Odontodactylus* telson indicating terms used in descriptions.

Odontodactylus Bigelow, 1893

Gamaris H. S., 1876, p. 275.—Holthuis, 1951, p. 86. [Suppressed by ICZN, now on Official Index, no. 122.]

Odontodactylus Bigelow, 1893, p. 100; 1894, p. 495.—Kemp, 1913, p. 133.—Hansen, 1926, p. 22.—Bigelow, 1931, p. 144.—Balss, 1938, p. 131.—Holthuis, 1951, p. 86.—Hemming, 1954, p. 155.—Holthuis and Manning, in press.—Manning, 1967, in press.

Odonterichthus Bigelow, 1894, p. 543.—Jurich, 1904, p. 396.—Gurney, 1946, p. 168 [listed; larva].

DEFINITION.—Surface of body smooth; cornea subglobular, set very obliquely on stalk; rostral plate without anterior spine; antennal protopod without papillae; carapace rounded anterolaterally and posterolaterally, without carinae; cervical groove not distinct across dorsum of carapace, position indicated on gastric grooves only; 5 epipods present; mandibular palp present; raptorial claw short, stout, dactylus inflated at base; inner margin of dactylus with teeth; propodus without proximal movable spine, superior margin not pectinate but distally serrate; ischiomeral articulation distal to terminus of merus; inferior surface of merus not ventrally channelled throughout its length for reception of propodus; endopod of walking legs elongate, 2-segmented; exposed thoracic somites without sharp carinae; abdomen semicylindrical, without sharp carinae on first 5 somites; sixth somite with 6 or more carinae but only 6 terminating in spines; telson with sharp median carina and numerous longitudinal carinae on dorsal surface; 3 pairs of marginal teeth, submedians with movable apices; submedian denticles numerous; 2 fixed intermediate and 1 fixed lateral denticle present; basal prolongation of uropod with outer spine the longer.

TYPE-SPECIES.—*Cancer scyllarus* Linnaeus, 1758, p. 633, by subsequent selection by Bigelow, 1931, p. 144 (ICZN Official List no. 731).

GENDER.—Masculine.

NUMBER OF SPECIES.—Five.

DISCUSSION.—In 1913 Kemp recognized 10 species of *Odontodactylus*, as follows: *O. scyllarus* (Linnaeus, 1758), *O. japonicus* (de Haan, 1844), *O. cultrifer* (White, 1850), *O. elegans* (Miers, 1880), *O. brevirostris* (Miers, 1884), *O. hansenii* (Pocock, 1893), *O. carinifer* (Pocock, 1893), *O. havanensis* (Bigelow, 1893), *O. latirostris* Borradaile, 1907, and *O. southwelli* Kemp, 1911. Of these, only *O. havanensis* occurred in the Atlantic; the remainder were known only from the Indo-West Pacific.

Hansen (1926) placed four of these species into synonymy. *O. carinifer* was synonymized with *O. cultrifer*, *O. elegans* with *O. scyllarus*, and both *O. latirostris* and *O. southwelli* with *O. hansenii*.

Bigelow (1931) agreed that *O. latirostris* and *O. hansenii* were conspecific but questioned the identity of *O. southwelli* with *O. hansenii*.

Since 1913, the following taxa have been described: *O. mindanaoensis* Roxas and Estampador, 1930, from the Philippines; *O. nigricaudatus* Chace, 1942, from the Gulf of Mexico; and *O. cultrifer* var. *tridentata* Serène, 1954, from Viet Nam.

The present study shows that only four of the 14 nominal species once ascribed to this genus can be recognized as distinct species. A fifth species, from Hawaii, is described as new.

Odontodactylus now includes the following species (asterisk indicates that types of the species have been examined for this study):

oldest name	*synonyms*
O. scyllarus (Linnaeus, 1758)	**G. bleekeri* A. Milne-Edwards, 1868 **G. elegans* Miers, 1884
**O. japonicus* (de Haan, 1844)	*G. edwardsii* Berthold, 1845
**O. cultrifer* (White, 1850)	**G. carinifer* Pocock, 1893 *O. mindanaoensis* Roxas and Estampador, 1930 *O. cultrifer* var. *tridentata* Serène, 1954
**O. brevirostris* (Miers, 1884)	**G. havanensis* Bigelow, 1893 **G. hansenii* Pocock, 1893 **O. latirostris* Borradaile, 1907 *O. southwelli* Kemp, 1911 **O. nigricaudatus* Chace, 1942

**O. hawaiiensis*, new species

Kemp (1913) noted that relatively little was known about variation in adults and ontogenetic changes in members of the genus. Young specimens are quite different from adults and these differences have been the primary reason for the multiplicity of names in the genus. Original descriptions of the following species, for example, are based on postlarvae or juveniles: *Gonodactylus brevirostris*, *G. carinifer*, *G. elegans*, *G. hansenii*, and *G. havanensis*.

In *Odontodactylus* the following features used in the past to diagnose species, may change with age:

1. Eye size: The cornea is relatively smaller in adults than in juveniles. In *O. scyllarus* the CI is about 300 in specimens 25 mm long, whereas in specimens over 100 mm long the CI is in excess of 576 and as large as 750.

2. Raptorial claw: The swollen portion of the dactylus of the claw is proportionally more inflated in adults than in juveniles; further, the characteristic basal notch present on the dactylus of young specimens disappears in adults.

3. Sculpture of the last abdominal somite: In very young specimens, including postlarvae and some early juveniles, the carinae of the sixth abdominal somite are not fully developed. Apparently the

only species in which the full complement of carinae (one pair of submedians, recurved posteriorly; one pair each of intermediates and laterals) on this somite are not developed in the adult is *O. cultrifer* (White).

4. Sculpture of the telson: In specimens with a TL of less than 30 mm all the carinae of the telson may not be present. In postlarvae and early stage juveniles only the median carina and the anterior portions of the submedian carinae may be present. Young specimens also may not exhibit the same degree of development of the carinae as do the adults. In general, the two pairs of accessory median carinae are the last to develop.

5. Uropod structure: The relative lengths of the two segments of the uropodal exopod may change with increasing size. In juveniles the distal segment may only be one-half or two-thirds as long as the proximal, whereas in adults the segments may be subequal in length. The last movable spine on the outer margin of the uropod is shorter in large specimens than in small ones. The relative lengths also differ in each species; *O. cultrifer* is the only species in which the proximal segment is always shorter than the distal.

Four important characters do not change with age: (1) the position of the ocular scales, whether appressed or separate; (2) the setation of the antennal scale; (3) the number of teeth on the dactylus of the raptorial claw; (4) and the presence of posterolateral spines on the fifth abdominal somite.

Key to Species of *Odontodactylus* (Adults)

1. Ocular scales appressed along midline; telson with 2 pairs of accessory median carinae 2
   Ocular scales separate; telson with 1 pair of accessory median carinae . . 4
2. Fifth abdominal somite unarmed posterolaterally; telson with longitudinal carina extending anteriorly from inner intermediate denticle. **japonicus**, p. 7.
   Fifth abdominal somite with posterolateral spines; telson lacking longitudinal carina extending anteriorly from inner intermediate denticle 3
3. Dactylus of claw with less than 5 teeth; movable spines of uropodal exopod broad, inflated distally . . . . . **scyllarus**, p. 10.
   Dactylus of claw with more than 5 teeth; movable spines of uropodal exopod tapering distally . . . . . **hawaiiensis**, new species, p. 16.
4. Median carina of telson thin, high; dactylus of claw with less than 5 teeth; posteriorly recurved portion of submedian carinae of fifth abdominal somite absent . . . . . **cultrifer**, p. 18.
   Median carina of telson not noticeably thin or high; dactylus of claw with more than 5 teeth; submedian carinae of fifth abdominal somite recurved posteriorly . . . . . **brevirostris**, p. 22.

Odontodactylus japonicus (de Haan, 1844)

FIGURE 2

Gonodactylus japonicus de Haan, 1844, pl. 51 (fig. 7); 1849, p. 225 [text].—Miers, 1880, p. 116.—Gee, 1925, p. 163 [listed].

Gonodactylus Edwardsii Berthold, 1845, p. 48; 1847, p. 30, pl. 3 (fig. 6).

Odontodactylus japonicus.—Bigelow, 1894, p. 496 [key].—Borradaile, 1907, p. 212.—Kemp, 1913, p. 139.—Alexander, 1916, p. 10.—Parisi, 1922, p. 110, fig. 5.—Komai, 1922, p. 102, figs. 1–2.—Kemp and Chopra, 1921, p. 297 [listed].—Komai, 1927, p. 336, pl. 13 (figs. 3–4) [part].—Komai, Akatsuka, and Ikari, 1927, p. 295 [listed].—Komai and Ikari, 1929, p. 121.—Schmitt, 1929, p. 147 [listed].—Komai, 1938, p. 272.—Holthuis, 1941, p. 276.—Anonymous, 1945, p. 845, fig. 2428, pl. 7 [color].—Stephenson and McNeill, 1955, p. 248.—Utinomi, 1956, p. 92, pl. 46 (fig. 8) [color]; 1960, p. 114, pl. 57 (fig. 2) [color].—Stephenson, 1960, p. 61; 1962, p. 35.—Shiino, 1964, p. 291 [discussion].—Manning, 1965, p. 260.

Gonodactylus edwardsii.—Gee, 1925, p. 163 [listed].

Not *Odontodactylus japonicus*.—Bigelow, 1931, p. 145, pl. 1 (fig. 1).—Edmondson, 1946, p. 243. [= *O. hawaiiensis*, new species.]

MATERIAL.—1♀, 82.2; Saya del Malha Bank, Seychelle Ils., W. Indian Ocean; 100 m; June 9, 1905; J. S. Gardiner, M. A. Caius; UMZ.—1♀, 117.0; Ambovombé, south coast of Malagasy Republic; 60 m; Oct. 28, 1958; A. Crosnier, col.; USNM 120343—1♂, 142.0; Swatow, China; BMNH 84.2.—2 dry spec.; China; no. 167b, c; BMNH 40.3.7.17–18.—1 dry spec., CL 30.0; same; BMNH 46.114.—1 dry spec., CL 31.5; same; BMNH 49.55.—1♀, 107.0; Japan; type; RMNH 32.—1♀, ca. 141.0; Japan; Oct. 3–12, 1904; Doflein, col.; BMNH 1910.9.30.10.—1♂; Tokyo, Japan; 1906; M. Harmand; MNHNP.—2 spec.; Yokahama, Japan; 1902; Boucard; MNHNP.—1 dry ♂, ca. 125.0; 1 broken ♀; Japan; October 1901; UZM.—1♀, 109.0; Nagasaki, Japan; May 1909; J. Jordan, col.; UZM.—1♂, 150.0; 1♀, 132.5; no locality; BLIH 134.—1♂, 130.0; Hayama, Sagami Bay; Feb. 20, 1920; BLIH 135.—1♂, 115.3; off Hayama, Sagami Bay; 55 m; Feb. 2, 1952; BLIH 658.

DESCRIPTION.—Eyes subglobular, length of cornea greater than width; eyes extending beyond end of first segment of antennular peduncle; anterior margin of ophthalmic somite truncate, not noticeably projecting; ocular scales truncate, oblique to body line, appressed along midline.

Antennular peduncle about half as long as carapace.

Antennal scale large, ovate, longer or slightly shorter than carapace; anterior margin not setose, posterior margin lined with short setae; anterior margin of dorsal plate of antennal peduncle rounded.

Rostral plate triangular, appearing trapezoidal in dorsal view;

apex depressed, longitudinally sulcate, fitting snugly behind ocular scales.

Carapace narrowed anteriorly; lateral plates projecting slightly beyond base of rostral plate.

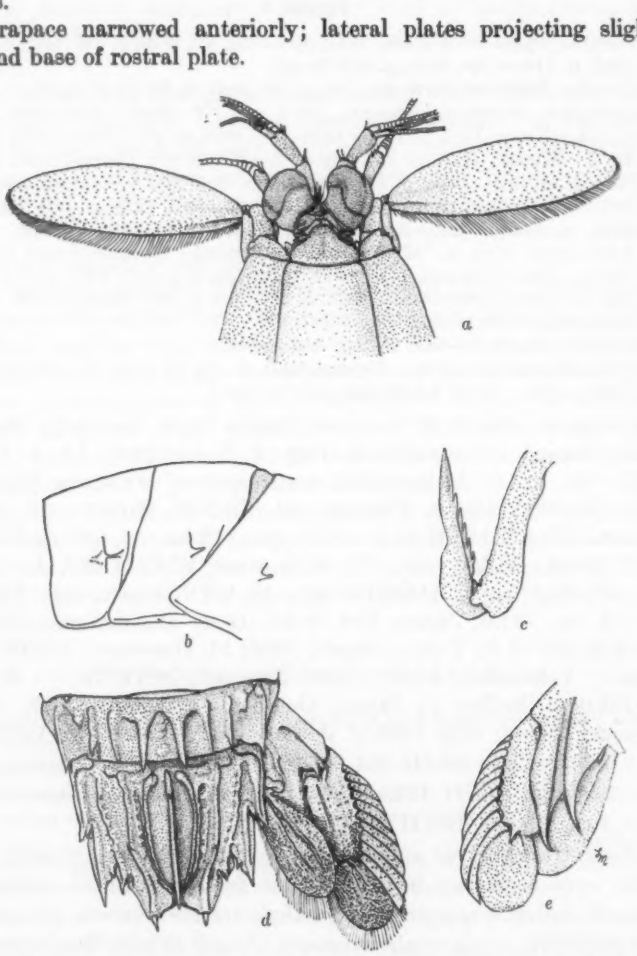

FIGURE 2.—*Odontodactylus japonicus* (de Haan), female, TL 117.0 mm, Madagascar: *a*, anterior portion of body; *b*, third to fifth abdominal somites in lateral view; *c*, propodus and dactylus of raptorial claw; *d*, sixth abdominal somite, telson, and uropod; *e*, uropod, ventral view, setae omitted.

Raptorial claw stout; dactylus armed with 6–8 teeth, outer margin of inflated basal portion rounded in large specimens.

Fifth thoracic somite lacking distinct lateral process, lateral portions of somite concealed under carapace; lateral processes of next

somites broadly rounded posteriorly, process of seventh somite larger than that of sixth; ventral keel on eighth thoracic somite broadly rounded, inclined posteriorly.

Abdominal somites smooth, strongly convex; longitudinal sulcus originating from anterolateral pit present on fifth somite, inconspicuous if present on fourth; posterolateral angles of first 5 somites rounded; sixth somite with 6 pairs of posterior spines (obsolete in large specimens), submedian carinae recurved posteriorly; anterior "knobs" present between intermediate and lateral carinae; at most a blunt lobe present in front of articulation of uropod; ventral surface of sixth somite with posterior margin concave along midline.

Telson slightly broader than long, greatest width at base, ornamented with carinae as follows: (1) median carina with short apical spine; (2) 2 pairs of accessory median carinae, inner much more prominent; (3) 1 pair of long submedians, anterior portions usually connected to posterior; (4) 1 pair of long curved carinae, extending from inner intermediate denticle almost to anterior margin of telson; (5) 1 pair of short intermediate carinae, each on tooth; (6) 1 pair of short lateral carinae, extending toward apex of the lateral tooth and fusing with the marginal carina; and (7) 1 pair of marginal carinae.

Outer margin of proximal segment of uropodal exopod with 10–12 broad, flattened, overlapping spines, last extending slightly beyond end of distal segment; distal 4 or 5 spines spatulate; proximal segment of uropodal exopod less than 1.5 times as long as distal segment; endopod broadly ovate with 2 longitudinal carinae not extending to apex; basal prolongation with outer spine the stronger, extending past proximal segment of exopod but not past endopod.

COLOR.—Komai (1922) noted that males are bright salmon red and females are salmon red anteriorly, bluish green posteriorly. None of the present specimens showed any color pattern in preservative.

SIZE.—Males, TL 125.0–150.0 mm; females TL 82.2–141–0 mm.

Measurements and indices for selected specimens of *O. japonicus* (de Haan) are as follows:

	♀	♀	♀	♀	♀	♂
Total length	82.2	107.0	109.0	117.0	141.0	142.0
Carapace length	18.2	22.9	22.1	25.1	29.7	29.7
Cornea length	5.0	5.3	5.4	5.7	6.2	6.3
Cornea width	4.3	4.5	4.7	5.0	5.7	5.7
Antennal scale length	17.9	22.3	24.0	24.2	–	31.5
Fifth abdominal somite width	18.2	22.3	23.2	25.5	30.1	29.0
Telson length	13.7	16.6	19.0	18.1	–	24.0
Telson width	14.7	18.8	19.3	21.2	–	24.6
CI	423	489	470	502	521	521
AWCLI	1000	1013	1049	1015	1013	976
Uropod P/D	1.50	1.40	1.42	1.31	1.51	1.36

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DISCUSSION.—Only two species of *Odontodactylus*, *O. scyllarus* (Linnaeus) and *O. hawaiiensis*, new species, have appressed ocular scales as well as two pairs of accessory median carinae on the telson. Both of these have at least the fourth and fifth abdominal somites armed posterolaterally and neither has a dorsal carina on the telson extending anteriorly from the inner intermediate denticle. In addition, *O. scyllarus* has less than five teeth on the claw; *O. hawaiiensis* agrees with *O. japonicus* in having more than five. *O. brevirostris* (Miers) and *O. cultrifer* (White) both differ from *O. japonicus* in having separate ocular scales and only one pair of accessory median carinae on the telson.

Komai (1927) noted that some young specimens of *O. japonicus* obtained from fish stomach contents could not be sexed but morphologically resembled adults. He further noted that two specimens had posterolateral spines on the fourth and fifth abdominal somites. Inasmuch as *O. japonicus* completely lacks these spines, Komai's specimens must be referred to *O. brevirostris*. The adults reported by Komai are probably *O. japonicus*.

No sexual dimorphism of morphological characters was noted in the specimens reported herein. Komai (1922) gave an account of dimorphism in color pattern and commented on an aberrant male with a pattern approaching that of a female.

DISTRIBUTION.—*O. japonicus* has been recorded from numerous localities around Japan and China, from three localities in Australia [Broome (Alexander, 1916) and Shark Bay or Exmouth Gulf, Western Australia (Stephenson, 1962), and off Wistari Reef, Capricorn Group, Queensland (Stephenson, 1960)], and from two localities in the Indian Ocean, south of the Seychelles (Borradaile, 1907) and the present record from Madagascar, in shallow water to 100 m.

Odontodactylus scyllarus (Linnaeus, 1758)

FIGURE 3

Cancer Scyllarus Linnaeus, 1758, p. 633.

Cancer scyllarus.—Linnaeus, 1767, p. 1054.—Holthuis, 1951, p. 86 [discussion].—Hemming, 1954, p. 158.—Holthuis and Manning, 1964, p. 139.

Gonodactylus scyllarus.—Latreille, 1828, p. 473.—H. Milne-Edwards, 1837, p. 529.—Miers, 1880, p. 115; 1880a, p. 459.—Bigelow, 1893, p. 100 [discussion].

Gonodactylus Bleekerii A. Milne-Edwards, 1868, footnote p. 65.—Miers, 1880, p. 118.

Gonodactylus elegans Miers, 1884, p. 566, pl. 52 (figs. B, b).

Odontodactylus bleekerii.—Bigelow, 1894, p. 496 [key].

Odontodactylus elegans.—Bigelow, 1894, p. 496 [key].—Kemp, 1913, p. 139.

Odontodactylus scyllarus.—Bigelow, 1894, p. 496.—Kemp, 1913, p. 135 [older references].—Bouvier, 1915, p. 312.—Sunier, 1918, p. 11.—Kemp and Chopra, 1921, p. 297 [listed].—Hansen, 1921, p. 79; 1926, pp. 22, 42 [larvae], pl. 2 (fig. 6).—Komai, Akatsuka, and Ikari, 1927, p. 295 [listed].—Komai and Ikari,

1929, p. 121.—Roxas and Estampador, 1930, p. 114.—Gravier, 1937, p. 200, figs. 17–19.—Serène, 1937, p. 68 [listed].—Komai, 1938, p. 271.—Serène, 1939, p. 349 [discussion].—Holthuis, 1941, p. 275.—Ward, 1942, p. 56.—Anonymous, 1949, p. 845, fig. 2429 [color].—Holthuis, 1951, p. 86.—Dawydoff, 1952, p. 145.—Stephenson, 1953, p. 46.—Serène, 1953, p. 507; 1954, pp. 6, 10.—Stephenson and McNeill, 1955, p. 248.—Utinomi, 1956, p. 92, pl. 46 (fig. 7).—Barnard, 1956, p. 22.—Kalk, 1958, pp. 75, 83.—Holthuis, 1959, p. 119, photo 10 (fig. 4).—Utinomi, 1960, p. 114, pl. 57 (fig. 3).—Serène, 1962, fig. 1E1.—Stephenson, 1962, p. 35.

MATERIAL.—1 broken ♂; Kilifi, 48 mi. north of Mombasa, Kenya; Mrs. G. Harvey; BMNH 1956.11.1.—1 ♂ 137.5; Zanzibar; BMNH 68.32.—1 spec., 23.5; Purse Is., Iles des Roches, Amirante Ils.; *Alert;* syntype of *Gonodactylus elegans;* BMNH 183.—1 ♂, 128.8; Seychelles; E. P. Wright; BMNH 75.20.—1 spec., ca. 22.8; Providence Is., north of Malagasy Republic; *Alert;* syntype of *Gonodactylus elegans;* BMNH 215.—2 spec.; Malagasy Republic; G. Petit; MNHNP.—1 ♂, 161.0; same; BMNH 63.31.—1 broken, 1 ♂, CL 36.0; Nosy Bé, Malagasy Republic; A. Crosnier; USNM 120342.—1♀, 135.2; Inhassaro, Mocambique; 1965; UCT.—1♀, 144.0; Mauritius; de Belloquet; MNHNP.—1 ♂, 87.0; same; Desjardins; MNHNP.—1 dry ♂, 158.0; same; BMNH 167a.—1 dry spec., CL 33.7; same; BMNH 42.66.—1♀, 74.0; Christmas Is.; C. W. Andrews; 1908; BMNH 1909.5.19.284.—1 ♂, 85.6; Poeloe Weh [north of Sumatra?]; P. Buitendijk; January 1911; RMNH 45.—1 spec.; Djakarta [Batavia], Indonesia; Bleeker; type of *G. bleekerii*?; MNHNP.—2♀, 74.3–85.5; harantoeka Flores, Indonesia; 1891; RMNH 1.—1 ♂; Lamakera, Lessa Sunda Ils.; Laurense; Dec. 21, 1909; ZMA.—1♀, 62.9; reede v. Koepang [Kupang?], Timor; Hendrickse; July 5, 1909; ZMA.—1 ♂, 99.3; New Guinea; BMNH 80.6.—1 ♂, 107.9; 1♀, 119.2; Banda; Semmelinck; 1841; RMNH 14.—1♀; Banda; van der Velde; ZMA.—1♀, 25.2; Banda anchorage; lithothamnion bank, 6–36 m; *Siboga* Sta. 240; Nov. 23–Dec. 1, 1899; ZMA.—2 ♂, 1♀; Ambon [Amboina]; W. Gerooms; 1913; ZMA.—2 ♂, 123.0–133.2; same; BMNH 80.6.—8 ♂, 111.0–141.0; 4♀, 98.5–140.5; same; H. Ludeking, 1863; L. M. Hoedt, 1864; RMNH 3.—3♀ [2 lots]; Moluccas; v. d. Hucht; 1858; ZMA.—4 spec.; Elat, west coast of Great Kei Is., Moluccas; reef; *Siboga* Sta. 261; Dec. 16–18, 1899; ZMA.—1♀, CL 25.7; Lette Is., Timor; BMNH 80.6.—1♀, 25.0; Puerto Galera, Mindoro, Philippines; Th. Mortensen; Mar. 2, 1914; UZM.—1♀, 129.4; Calapan, Mindoro, Philippines; P. de Mesa; December 1932–January 1933; MCZ 9616.—1♀, CL 26.5; Baie de Lovane, Viet Nam; Dawydoff; April 1933; MNHNP.—1 ♂, 108.7; Tutuila, American Samoa; Smithsonian Institution Pacific Project; Feb. 23, 1965; USNM 120264.—1 ♂, 160.0; Samoa; BMNH 75–67.—1♀, 142.0; same; A. B. Steinberger; USNM 5147.—1 ♂, 124.0; Rotuma, Fiji Ils.; J. S. Gardiner; UMZ.—

1 ♂, 53.9; Vanikoro, Santa Cruz Ils.; Templeton Crocker Expedition; June 5, 1933; USNM 120265.—1♀, 109.2; New Britain; Willey; 1895–1897; UMZ.—1 ♂, 109.0; Blanche Bay, New Britain; A. Willey; July 1895; BMNH 1918.2.25.1.—1♀, 103.2; Ifaluk Atoll, Caroline Ils.; Abbott and Yaniseiman, No. 643; Oct. 19, 1953; USNM 104702.—1 ♂, 143.5; Wakanoura, Japan; Jordan and Snyder; 1900; USNM 26346.

DESCRIPTION.—Eye subglobular, cornea small, length greater than width; eyes extend to or slightly beyond end of first segment of antennular peduncle; anterior margin of ophthalmic somite truncate, not noticeably projecting; ocular scales truncate, oblique to body line, appressed along midline.

Antennular peduncle shorter than carapace.

Antennal scale large, ovate, not as long as carapace; anterior surface of scale almost completely setose, anterior setae much shorter than posterior; dorsal plate of antennal peduncle quadrangular, anterior margin irregularly rounded or subtriangular.

Rostral plate triangular, short, not extending anteriorly past ocular scales; lateral margin rounded; apex may fit in space behind ocular scales; apex sharp, depressed, anterior half or third sulcate.

Carapace narrowed anteriorly, lateral plates projecting anteriorly just past base of rostral plate.

Raptorial claw stout; dactylus armed with 2–3 teeth, outer margin of swollen portion flattened, smooth or irregular.

Mandibular palp and 5 epipods present.

Fifth thoracic somite lacking distinct lateral process, entire somite usually concealed under carapace; lateral processes of next 2 somites irregularly rounded, process of seventh more rounded than sixth; ventral keel on eighth thoracic somite low, inclined posteriorly, broadly rounded or obliquely truncate.

Abdominal somites generally smooth; second to fifth with lateral longitudinal groove originating from anterior pit, increasing in sharpness posteriorly, upper and lower borders actually carinate on fifth somite; third to fifth or fourth and fifth somites with posterolateral spines, that of fifth somite largest, carinate; submedian, intermediate and lateral carinae of sixth somite with posterior spines; submedian carinae recurved posteriorly; prominent knobs present on anterior half of somite between intermediate and lateral carinae; no spine in front of articulation of uropod; ventral surface of sixth somite with bilobed posterior margin, median emargination present between lobes.

Telson broader than long, greatest width at apices of lateral teeth, ornamented with carinae as follows: (1) median carina with short posterior spine; (2) 2 pairs of accessory median carinae, inner longer, which converge under posterior apex of median carina, outer accessory

medians forming inconspicuous knob; (3) carinae of submedian teeth not always continuous with anterior submedians; (4) short subparallel

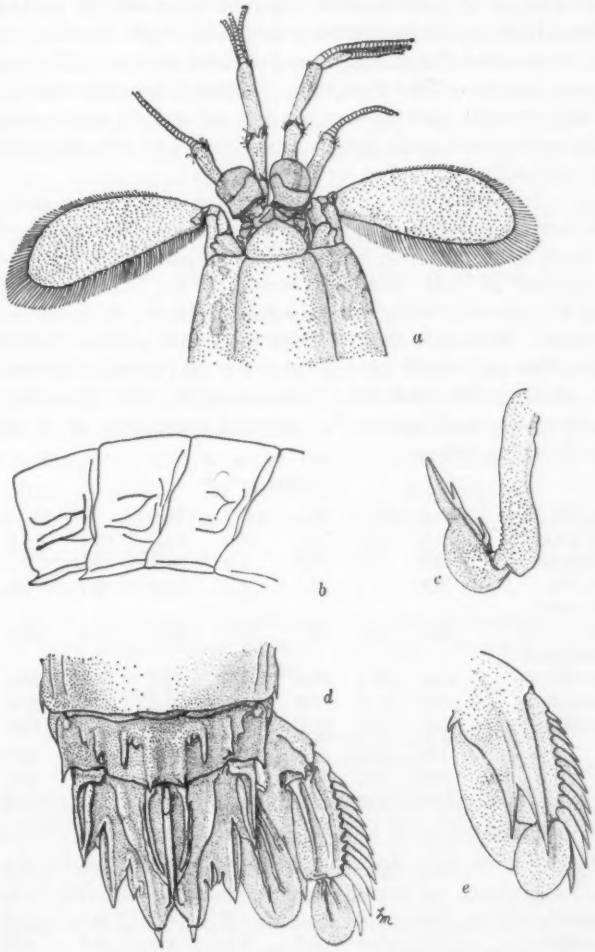


FIGURE 3.—*Odontodactylus scyllarus* (Linnaeus), female, TL 103.2 mm, Ifaluk Atoll: *a*, anterior portion of body; *b*, second to fifth abdominal somites, in lateral view; *c*, propodus and dactylus of raptorial claw; *d*, sixth abdominal somite, telson, and uropod; *e*, uropod, ventral view (setae omitted in *d* and *e*).

carinae present on inner side of submedian teeth; (5) short, swollen anterior margin on each large intermediate denticle; (6) carina of intermediate tooth not extending anteriorly much past base of tooth;

and (7) lateral carinae, each of which fuses with marginal carina at apex of lateral tooth.

Outer margin of penultimate segment of uropodal exopod with 10–11 broad, flattened, overlapping spines, last not extending to distal margin of rounded distal segment; proximal segment of exopod less than twice length of distal segment; endopod broadly ovate, with 2 dorsal longitudinal carinae that do not extend to apex; basal prolongation with outer spine longer than inner but not extending past apex of endopod.

COLOR.—In preservative, ventral surface and lateral portions of body darker than upper; dactylus of claw orange; antennal scale with distal black spot; anterior portions of carapace with irregular oval areas outlined in dark pigment, especially on lateral plates; basal segment of uropods yellow, distal segments black, apices of movable spines pink. Although much of the color and pattern fade in preservative, the oval spots on the carapace may persist for sometime.

SIZE.—Males, TL 53.9–171.0 mm; females, TL 22.8–144.0 mm.

Measurements and indices for selected specimens of *O. scyllarus* (Linnaeus) are as follows:

MALES								
Total length	53.9	87.0	97.5	108.7	124.0	–	143.5	160.0
Carapace length	12.0	21.6	22.5	26.0	27.5	36.0	37.0	39.0
Cornea length	3.4	4.6	4.7	5.0	4.7	5.7	5.7	5.7
Cornea width	2.8	3.9	4.2	4.1	4.2	4.7	5.5	5.2
Antennal scale length	10.0	17.6	18.7	21.6	22.0	28.8	28.7	30.3
Fifth abdominal somite width	11.6	20.8	22.3	26.5	26.1	35.0	34.5	36.6
Telson length	9.0	15.6	17.2	19.7	19.2	26.1	27.6	–
Telson width	9.4	17.6	17.7	21.2	22.2	29.3	28.9	–
CI	429	553	536	634	655	766	673	750
AWCLI	966	962	991	1019	949	972	932	938
Uropod P/D	1.39	1.75	1.79	1.43	1.89	1.65	1.52	1.88
FEMALES								
Total length	25.2	25.0	74.0	103.2	–	129.4	144.0	142.0
Carapace length	5.7	6.1	17.4	24.5	26.5	29.7	32.6	33.2
Cornea length	2.1	2.3	4.5	4.5	4.9	5.1	5.2	5.4
Cornea width	1.9	2.0	3.7	3.9	4.6	4.5	4.8	4.7
Antennal scale length	3.3	4.0	15.8	19.8	21.4	22.8	26.6	27.0
Fifth abdominal somite width	4.9	5.8	17.3	24.1	26.2	29.8	32.7	32.5
Telson length	3.8	4.1	14.2	18.1	–	22.7	25.3	26.0
Telson width	4.1	4.7	14.5	19.2	–	23.7	26.5	26.2
CI	300	305	470	628	576	660	679	706
AWCLI	859	950	994	983	988	1003	1003	978
Uropod P/D	1.62	1.88	1.63	1.60	1.80	1.64	1.78	1.56

DISCUSSION.—*O. scyllarus* can be distinguished from all other species in the genus by the presence of only two or three teeth on the dactylus of the claw and the presence of a full complement of carinae on the telson, including two pairs of accessory median carinae.

Kemp (1913) was correct in synonymizing *Gonodactylus bleekerii* A. Milne-Edwards, 1868, with *O. scyllarus*. Milne-Edwards' account included no mention of features that might distinguish his species from *O. scyllarus*, even though he mentioned the latter species in his discussion. A specimen in the Paris Museum collected by Bleeker in Batavia [Djakarta] is probably the type of *G. bleekeri* although it is not so labelled. It appears to be a normal *O. scyllarus*.

Hansen (1926) was the first to synonymize *G. elegans* Miers, 1884, with *O. scyllarus*. I have examined the types of *O. elegans*, two postlarvae or early juvenile females, and concur with Hansen. Although the carinae of the telson are poorly developed in those specimens, they may be well developed in other specimens of similar size.

Adults of *O. scyllarus* have smaller eyes than adults of any other species in the genus, and, as usual, the eyes in juveniles are comparably larger than in adults. In specimens of the "*elegans*" stage, the corneal index is 300, whereas in adults it ranges from 470 to 766.

Odontodactylus scyllarus was originally described by Linnaeus (1758, p. 633) as follows:

> Scyllarus. 55. C. macrourus articularis, manibus adactylis ventricosis rectis angulatis introrsum tridentatis. *Mus. Ad. Fr.* I. p. 86. C. mirabilis.
> *Rumph. mus.* t. 3. f. F. G.
> *Habitat in M. Asiatico.*
> *Statura praecedentis. Thoracis testa latere postico emarginata. Mucronum par pone pedes.*

As Holthuis (1959) pointed out, Rumphius' figure F on plate 3 is *O. scyllarus*, but figure G is the dactylus of a *Gonodactylus* since no teeth are shown on the terminal segment. In order to settle the identity of *O. scyllarus*, the specimen figured by Rumphius (1705) on plate 3, figure F, is here selected as the lectotype of the species.

REMARKS.—As in *O. brevirostris* (see below), there is some overlap in size between postlarvae and first stage of juveniles; Hansen (1926) commented on this in his account of *O. scyllarus*.

RANGE.—Through most of the Indo-West Pacific in shallow water; it is often found on coral reefs. There are no records from the Red Sea, South Africa, or Hawaii, but there are scattered records from many localities between East Africa and Japan.

Odontodactylus hawaiiensis, new species

FIGURE 4; PLATE 1

Odontodactylus japonicus.—Bigelow, 1931, p. 145, pl. 1 (fig. 1).—Edmondson, 1946, p. 243. [Not *O. japonicus* (de Haan, 1844).]

HOLOTYPE.—1 ♂, 107.0; off coast of Maui Is., Hawaiian Ils.; 173–276 m; *Albatross* Sta. 4098; July 23, 1902; USNM 64861.

PARATYPE.—1♀, 29.4; off south coast of Molokai Is., Hawaiian Ils.; 109–116 m; *Albatross* Sta. 3845; Apr. 8, 1902; USNM 64863.

OTHER MATERIAL.—1 ♂, 32.2; off northeast coast of Hawaii Is., Hawaiian Ils.; 151–206 m; *Albatross* Sta. 4062; July 18, 1902; USNM 64862.

DESCRIPTION.—Eye large, cornea longer than broad, set obliquely on short stalk; ocular scales oblique, appressed along midline; eyes not extending to end of second segment of antennular peduncle.

Antennular peduncle short, about two-thirds as long as carapace.

Antennal scale broad, ovate, completely setose, anterior setae smaller than posterior; scale five-sixths length of carapace.

Rostral plate short, triangular, with acute, deflexed apex; plate anteriorly sulcate along midline; apex of plate extending to posterior margin of ocular scales.

Dactylus of raptorial claw with 7–8 teeth.

Abdomen smooth, second to fifth somites with anterolateral pit and shallow groove posterior to each pit, grooves increasing in size posteriorly; groove of fifth somite with prominent, almost carinate margins; fourth and fifth somites each with posterolateral spinules; sixth somite with faintly indicated lobe in front of articulation of uropod; sixth somite with 3 pairs of primary carinae, submedians, intermediates, and laterals armed with at most apical tubercles in holotype; submedians each with posteriorly reflected carina, not extending to posterior margin; broad tubercle present on each side between intermediate and lateral carinae.

Telson broader than long, with full complement of carinae; 2 pairs of accessory medians present, outer irregular; submedians faintly suppressed at base of marginal teeth, extending almost to anterior margin of telson; submedian tooth and first intermediate denticle with short dorsal carina, carina of denticle not extending anteriorly past base of denticle; short intermediate, lateral, and marginal carinae present, laterals extending obliquely to apex of tooth; low anterior swellings present lateral to outer accessory median and submedian carinae.

Outer margin of proximal segment of uropodal exopod with 11–12 broad, tapering, upturned spines, last extending to or beyond mid-length of distal segment; distal segment of uropod more than half as long as proximal.

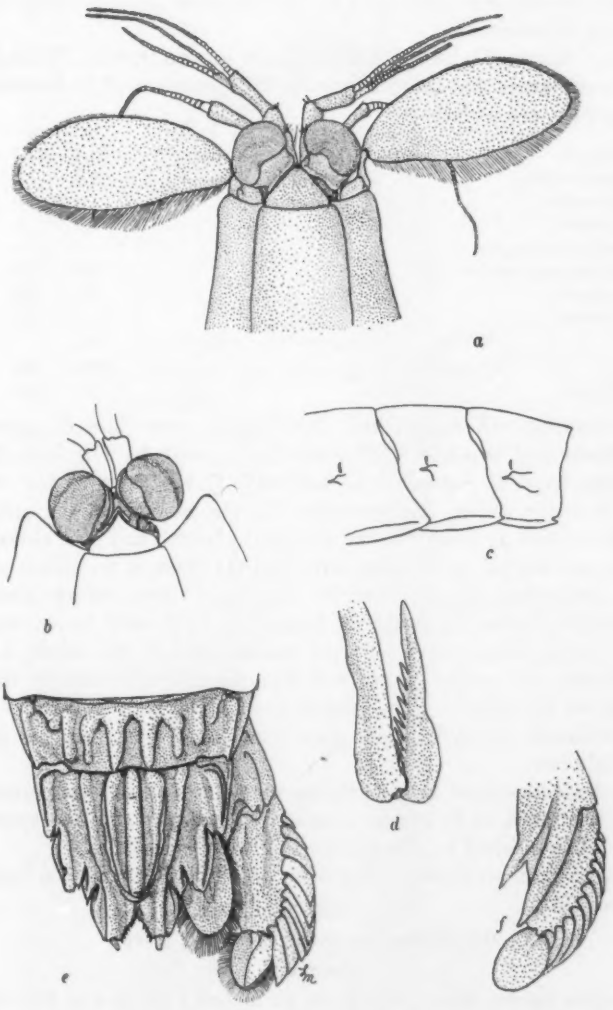


FIGURE 4.—*Odontodactylus hawaiiensis*, new species, male holotype, TL 107.0 mm, Hawaii: *a*, anterior portion of body; *b*, oblique frontal view of carapace and ocular scales; *c*, third to fifth abdominal somites in lateral view; *d*, propodus and dactylus of raptorial claw; *e*, sixth abdominal somite, telson, and uropod; *f*, uropod, ventral view (setae omitted).

COLOR.—Almost completely faded in all specimens. The smaller male has traces of a black spot on the uropodal exopod similar to that found in *O. brevirostris*.

SIZE.—Males, TL 32.2–107.0 mm; only known female, TL 29.4 mm.

Measurements and indices for selected specimens of *O. hawaiiensis*, new species, are as follows:

	♀	♂	♂
Total length	29.4	32.3	107.0
Carapace length	6.3	7.5	24.0
Cornea length	–	–	6.0
Cornea width	2.0	–	5.6
Antennal scale length	–	–	20.8
Fifth abdominal somite width	6.2	7.0	22.7
Telson length	4.0	4.6	16.5
Telson width	5.0	5.9	19.2
CI	315	–	429
AWCLI	1016	933	945
Uropod P/D	1.48	1.55	1.60

DISCUSSION.—*O. hawaiiensis* most closely resembles *O. japonicus* (de Haan) and was identified with that species by Bigelow (1931). It differs from *O. japonicus* as follows: (1) the apex of the rostral plate is acute, sharp, not truncate; (2) the margin of the antennal scale is completely lined with setae; (3) the fourth and fifth abdominal somites are armed posterolaterally; and (4) there is no carina on the telson extending anteriorly from the inner intermediate denticle. *O. hawaiiensis* also resembles *O. brevirostris* in general facies, but the latter species has a more rounded rostral plate in the adult, a deep pit between the ocular scales, and but one pair of accessory median carinae on the telson. *O. scyllarus* and *O. cultrifer* both differ from *O. hawaiiensis* in having less than 5 teeth on the dactylus of the raptorial claw.

Small specimens of *O. hawaiiensis* may have an anterior groove in the rostral plate, as in *O. brevirostris*, but even the smallest specimen can be distinguished by the position of the ocular scales.

DISTRIBUTION.—Known only from off Hawaii, in depths between 109 and 276 m.

Odontodactylus cultrifer (White, 1850)

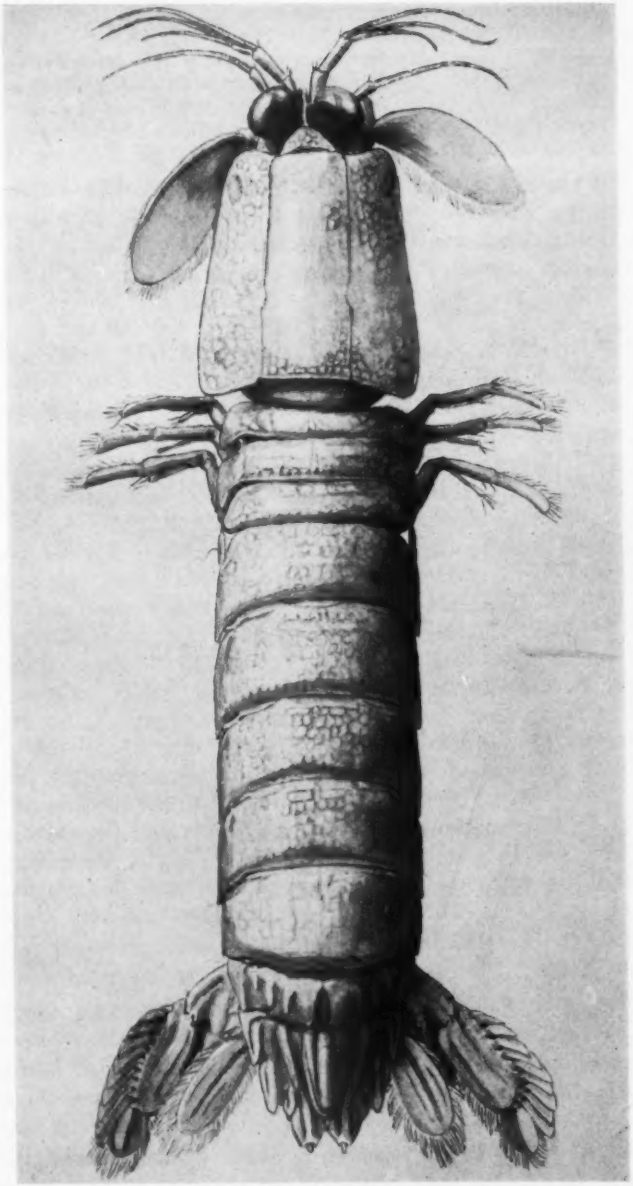
FIGURE 5

Gonodactylus cultrifer White, 1850, p. 96, pl. 16 (figs. 1–2); 1851, p. 422.—Miers, 1880, p. 117.—Lanchester, 1901, p. 555.

Gonodactylus carinifer Pocock, 1893, p. 478, pl. 20B (figs. 4a–b).

Odontodactylus carinifer.—Bigelow, 1894, p. 496 [key].—Kemp, 1913, p. 138.—Gravier, 1933, p. 78, figs. 3–5.—Serène, 1937, p. 68 [listed].—Dawydoff, 1952, p. 145 [discussion].—Serène, 1953, p. 506.

Odontodactylus cultrifer.—Bigelow, 1894, p. 496 [key].—Kemp, 1913, p. 137.—Sunier, 1918, p. 11.—Kemp and Chopra, 1921, pp. 297 [listed], 307.—Odhner, 1923, p. 7.—Hansen, 1926, p. 23 [discussion].—Stephenson, 1952, p. 10;



Odontodactylus hawaiiensis, new species, male holotype, TL 107.00 mm, Hawaii: Specimen in dorsal view (from Bigelow, 1931).

1953, p. 46.—Serène, 1953, p. 506; 1954, pp. 6, 8, 11, 13, 17, 72, pl. 6 (figs. 5–6).—Stephenson and McNeill, 1955, p. 248.—Stephenson, 1962, p. 35.—Serène, 1962, fig. 1E2.—Manning, 1966, p. 105.

Odontodactylus cultifer.—Schmitt, 1929, p. 147 [listed].

Odontodactylus mindanaoensis Roxas and Estampador, 1930, p. 115, pl. IV.

Odontodactylus cultrifer var. *tridentata* Serène, 1954, pp. 6, 7, 8, 72, pl. 6 (figs. 7–8).

MATERIAL.—1 broken ♂, 125.4; 10 mi. northwest of Bustard Head, off Port Curtis, Queensland, Australia; 29 m; *Endeavour;* AM E.3154.—1 broken ♀, 106.5; Platypus Bay, Queensland; 13–16 m; *Endeavour;* USNM 111380.—1♀, 118.2; same; *Endeavour*, no. 1, haul 2; July 28, 1910; AM P.3549.—1 broken ♂; 2♀, 92.0–93.5; ca. 5 mi. east northeast of Scarborough edge of northern Banks, Moreton Bay, Queensland; 9 m; Mar. 29, 1966; W. Stephenson, M. Rees; USNM 120266.—2♂, 101.4–118.7; 1♀, 86.7; Eastern Banks, northern Moreton Bay, Queensland; ca. 9 m; Mar. 29, 1966; W. Stephenson, M. Rees; USNM 120267.—1♂, 28.0; Holothuria Bank; 44 m; holotype of *Gonodactylus carinifer* Pocock; BMNH 92.3.26.460.—1♂, 93.7; off Frederick Hendrik Is., New Guinea; Feb. 10, 1955; D. C. Lwolla; RMNH 354.—1♂, 67.2; Maculabo Is., Philippine Ils.; June 13, 1909; *Albatross;* USNM 76024.—1♀, ca. 70.0; Malatrjo Point, Batanjas, Philippine Ils.; 1938; AMNH 8253.—2♀, 57.3–66.5; Poulo Condore Ils., off Viet Nam; March 1931; Dawydoff; MNHNP.—2 dry ♂, CL 20.4, 20.5; China; Dr. Cuming; syntypes; BMNH 49.55.—2 dry ♂ (in 2 lots), each 110.0; China; S. Heymann; UZM.

DESCRIPTION.—Eyes subglobular, cornea length greater than width; eyes extending to or beyond end of second segment of antennular peduncle; anterior margin of ophthalmic somite truncate, projecting slightly; ocular scales rounded, widely separate, lacking prominent pit between them on midline.

Antennular peduncle about two-thirds carapace length.

Antennal scale large, ovate, about as long as carapace; margin completely setose, anterior setae smaller than posterior; dorsal plate of antennal peduncle rounded.

Rostral plate trapezoidal, anterior margin deflexed, transverse, with faint median sulcus; lateral margins concave.

Carapace narrowed anteriorly, anterior margin evenly curved, concave anteriorly; posterior margin concave medially.

Raptorial claw small, dactylus armed with 3–5 teeth; basal, swollen portion of dactylus rounded; ischium with prominent ventral keel, projecting anteriorly.

Fifth thoracic somite without definite lateral process; lateral process of sixth thoracic somite truncate, that of seventh somite rounded, neither with prominent posterior lobe; ventral keel on eighth somite low, inconspicuous.

First 5 abdominal somites lacking carinae, second to fifth somites each with anterolateral pit; fifth somite with minute posterolateral spine, situated anterior to posterolateral angle; sixth somite with 3

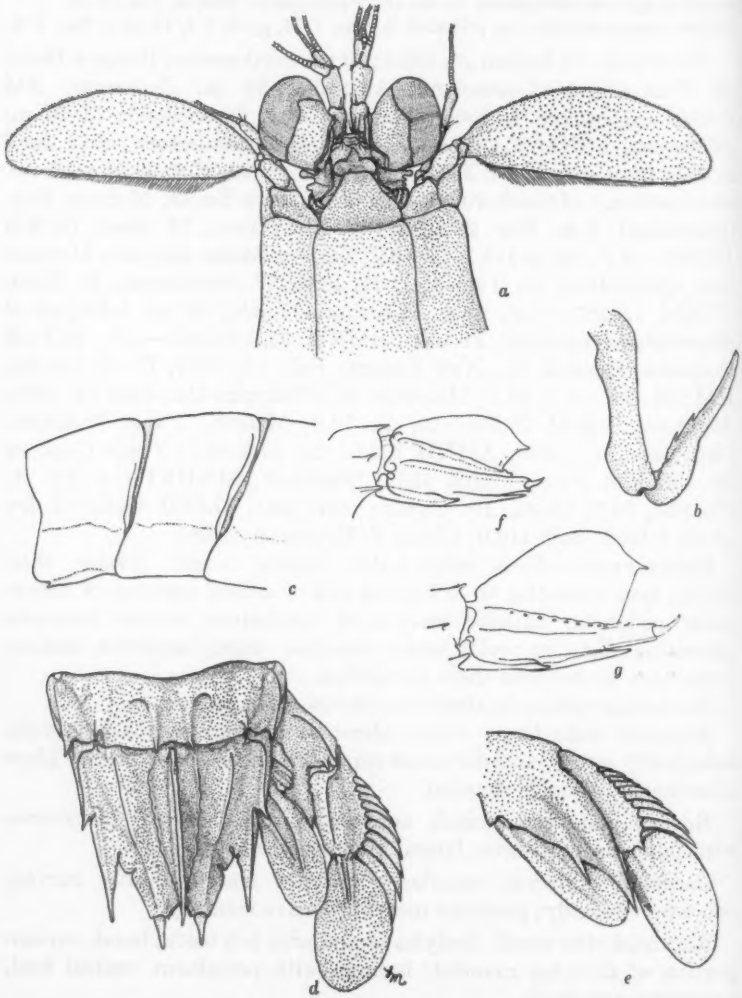


FIGURE 5.—*Odontodactylus cultrifer* (White). Male TL 67.2 mm, Philippine Islands: *a*, anterior portion of body; *b*, propodus and dactylus of raptorial claw; *c*, third to fifth abdominal somites, in lateral view; *d*, sixth abdominal somite, telson, and uropod; *e*, uropod, ventral view (setae omitted in *d*, *e*). Female, TL 106.5 mm, Platypus Bay: *f*, telson in lateral view. Male, TL 125.4 mm, off Port Curtis: *g*, telson in lateral view.

pairs of carinae terminating in spines, posteriorly recurved portion of submedians absent; anterior tubercle present between intermediate and lateral carinae; sixth somite without ventrolateral spine in front of articulation of uropod, ventral posterior margin almost transverse, not strongly concave.

Telson slightly broader than long, appearing elongate; median carina thin, strongly convex, high, about one-fourth telson width in female, almost one-half telson width in males, with strong posterior spine; dorsal surface of telson, lateral to crest, ornamented with (1) a single accessory median carina, (2) a long, uninterrupted submedian carina, (3) a short carina on intermediate tooth, and (4) a lateral carina subparallel to and separated from marginal carina by a narrow space, 2 small swollen, tubercles situated lateral to termination of each submedian carina.

Uropod broad, dorsal spine of basal segment very small; distal segment of exopod longer than proximal; 8–9 movable spines on outer margin of proximal exopod segment, last not extending to midlength of distal segment; endopod ovate, with 2 swollen, short, longitudinal carinae.

Color.—Faded in most specimens. Relatively fresh specimens show traces of dark chromatophores scattered over the body, but concentrated in an oblique line on the first abdominal somite just behind the articulated plates and on the telson at the base of the median carina; some specimens have pairs of submedian pink spots on the last three thoracic and first five abdominal somites; the distal portion of the antennal scales and tips of the uropod are pink. Komai (1927, 1938) and Stephenson (1952) have also given notes on color.

Measurements.—Males, TL 28.0–125.4 mm; females, TL 57.3–118.2 mm.

Measurements and indices for selected specimens of *O. cultrifer* (White) are as follows:

	♀	♀	♂	♀	♂	♀	♂
Total length	57.3	66.5	67.2	70.0	93.7	106.5	125.4
Carapace length	11.1	13.1	13.2	13.5	18.2	19.6	23.5
Cornea length	3.6	4.1	4.6	4.7	5.0	6.0	5.6
Cornea width	3.9	4.2	4.1	4.5	5.0	6.4	6.1
Antennal scale length	10.8	13.0	13.1	–	–	–	26.9
Fifth abdominal somite width	12.2	14.4	13.7	15.0	19.1	20.6	24.5
Telson length	9.1	10.6	10.2	11.4	14.7	16.2	20.0
Telson width	10.9	11.5	11.0	12.3	15.4	16.8	20.0
CI	285	312	322	300	364	306	385
AWCLI	1099	1099	1037	1111	1049	1051	1042
Uropod P/D	0.879	0.900	0.640	0.929	–	0.814	0.775
Telson W/Crest Ht	220	329	367	362	230	381	235

DISCUSSION.—The most distinctive feature of *O. cultrifer* is the relative size of the segments of the uropodal exopod; in no other species of the genus is the distal segment longer than the proximal. The median carina of the telson is characteristically slender and highly arched dorsally, and it is much higher in mature males than in mature females. In females the telson width/median carina height ratio ranges from 3.29 to 4.55, in males from 2.17 to 3.67.

Pocock (1893) was the first to suggest that his *O. carinifer* might be the young stage of *O. cultrifer*, and Hansen (1926) synonymized the former with the latter. After examining the type of *O. carinifer*, I must agree with Hansen. In 1966 I pointed out that *O. mindanaoensis* Roxas and Estampador should be referred to *O. cultrifer*. The type of *O. mindanaoensis* is a small female with a low median carina on the telson; the description and figures agree with *O. cultrifer* in all respects but one: the distal segment of the uropodal exopod is shorter than the proximal. The illustration is highly stylized so the size of the two segments may not have been drawn correctly.

O. cultrifer var. *tridentata* Serène, 1954, was also provisionally synonymized with *O. cultrifer* by me in 1966. I can find no characters to distinguish the varietal form from *O. cultrifer* sensu stricto; the variety seems to have been recognized on the basis of a larger number of teeth on the claw and a relatively lower median carina on the telson. In my material the height of the median carina varies somewhat and there may be three, four, or five teeth on the dactylus of the claw.

DISTRIBUTION.—Western Pacific Ocean, from Australia and New Guinea northward to Japan, in shallow water.

Odonodactylus brevirostris (Miers, 1884)

FIGURES 6–8

Gonodactylus brevirostris Miers, 1884, p. 567, pl. 52 (fig. c)[*Gonodactylus elegans* in legend].

Gonodactylus Havanensis Bigelow, 1893, p. 101 [June].

Gonodactylus Hansenii Pocock, 1893, p. 477, pl. 20B (figs. 3–3b)[June].

Odontodactylus brevirostris.—Bigelow, 1894, p. 496 [key].—Tattersall, 1906, p. 172, pl. 2 (figs. 16–18).—Borradaile, 1907, p. 212.—Kemp, 1913, p. 143.—Kemp and Chopra, 1921, p. 297 [listed].—Komai, 1938, p. 272, fig. 2.—Edmondson, 1946, p. 243.—Manning, 1967, in press [summary of Atlantic records].

Odontodactylus havanensis.—Bigelow, 1894, p. 497, text-figs. 1–2, pl. 20.—Kemp, 1913, p. 204 [listed].

Odontodactylus hanseni.—Bigelow, 1894, p. 496 [key].—Kemp, 1913, p. 140.—Dawydoff, 1952, p. 146 [*G. hansenii* on p. 145].—Townsley, 1953, p. 421, figs. 18–19.

Odontodactylus latirostris Borradaile, 1907, p. 212, pl. 22 (figs. 3, 3a).—Kemp, 1913, p. 141.

Odontodactylus southwelli Kemp, 1911, p. 94; 1913, p. 142, pl. 9 (figs. 103–106).—Kemp and Chopra, 1921, p. 297 [listed].

Odontodactylus hansenii.—Edmondson, 1921, p. 297, fig. 1f.—Bigelow, 1931, p. 147, fig. 2.—Edmondson, 1946, p. 243.

Odontodactylus hansenii.—Hansen, 1926, pp. 23, 44 [larvae], pl. 2 (figs. 7–9).
?*Odontodactylus japonicus.*—Komai, 1927, p. 336 [part].
Odontodactylus nigricaudatus Chace, 1942, p. 88, pl. 28; 1954, p. 449.

MATERIAL.—2♀, 17.2–53.4; Amirante Ils.; 46–146 m; J. S. Gardiner, M. A. Caius; syntypes of *O. latirostris;* UMZ.—1♀, 26.2; Seychelles; 62 m; Oct. 20, 1905; J. S. Gardiner, M. A. Caius; UMZ.—1♂, 23.3; Providence Is., south of the Seychelles Ils.; *Alert,* col., holotype of *G. brevirostris;* BMNH 82.27.—1♀, 55.2; east of Lowi and Lowalafuri Ils., south entrance to Fadifolla Atoll, Maldive Ils.; 05°20′ N, 73°29′ E; 46–64 m; *Te Vega* Sta. 122 A+B; Mar. 25, 1964; J. S. Garth; USNM 120260.—1♀, 13.8; Oyster Banks, Manaar, Ceylon; Herdman Collection; BMNH 10.27.5.—1♀, ca. 13.7; no local; 10 m to surface; *Siboga;* Apr. 3, 1900; ZMA.—1♀, 30.5; Anchorage east of Dangar Basin, Saleh-bay, Sumbawa, Indonesia; 36 m; *Siboga* Sta. 313; Feb. 14–16, 1900; ZMA.—1♂, 13.0; Mamoedjoe, west coast of Celebes; *Snellius* Exped.; Aug. 5, 1929; RMNH 288.—1♂, 25.4; Lembeh Strait, Celebes; June 14, 1929; Herre; USNM 120261.—1♂, 25.5; Banda anchorage; *Siboga* Sta. 240; Nov. 22–Dec. 1, 1899; ZMA.—1♀, 36.6; Amboina Bight, Indonesia; 91 m; Mar. 3, 1922; Danish Expedition to Kei-Qeme, 1922; UMZ.—1♀, 59.0; off northwest New Guinea; 00°07.2′ N, 130°25.5′ E; 83–59 m; *Siboga* Sta. 154; Aug. 14, 1899; ZMA.—1♂, 16.0; off northwest New Guinea; 01°42.5′ S, 130°47.5′ E; 32 m; *Siboga* Sta. 164; August 1899; ZMA.—1♂, 16.1; North-Ubian, Philippine Ils.; 06°07.5′ N, 120°26′ E; surface; *Siboga* Sta. 99; June 28–30, 1899; ZMA.—1 broken ♂, CL 13.7; Jolo, Philippine Ils.; 46 m; Mar. 19, 1914; Th. Mortensen; UMZ.—1 broken ♀, ca. 61.5; Macclesfield Bank, South China Sea; holotype of *Gonodactylus hansenii;* BMNH 92.8.28.13.—1♂, 26.5; Waikiki, Oahu, Hawaiian Ils.; 1921; D. Kuhns; USNM 56048.—1♀, 32.7; Hawaii; 1916; Thaanum, col.; UZM.—1♂, 50.4; southern coast of Molokai Is., Hawaiian Ils.; 109–116 m; *Albatross* Sta. 3845; Apr. 8, 1902.—1♀, 26.7; Pailolo Channel, between Molokai and Maui Ils. and northeastern approach, Hawaiian Ils.; 55–95 m; *Albatross* Sta. 3861; Apr. 10, 1902; USNM 64869.—1♂, 56.9; off Kaui Is., Hawaiian Ils.; 424–73 m; *Albatross* Sta. 3982; June 10, 1902; USNM 64865.—1♀, 79.4; Penguin Bank, southern coast of Oahu Is., Hawaiian Ils.; 49–51 m; *Albatross* Sta. 4031; July 9, 1902; USNM 64864.—1♀, 26.9; same; 51–25 m; *Albatross* Sta. 4034; July 9, 1902; USNM 64868.—1♂, 31.7; northeastern coast of Hawaii Is., Hawaiian Ils.; 44–151 m; *Albatross* Sta. 4061; USNM 64867.

DESCRIPTION.—Eye large, cornea subglobular, set obliquely on short stalk; eyes extending to or slightly beyond end of second segment of antennular peduncle; ocular scales oblique to body line, separate,

connected by median, concave ridge defining a deep pit between the scales.

Antennular peduncle short, about five-sixths as long as carapace. Antennal scales elongate, slightly shorter than median length of

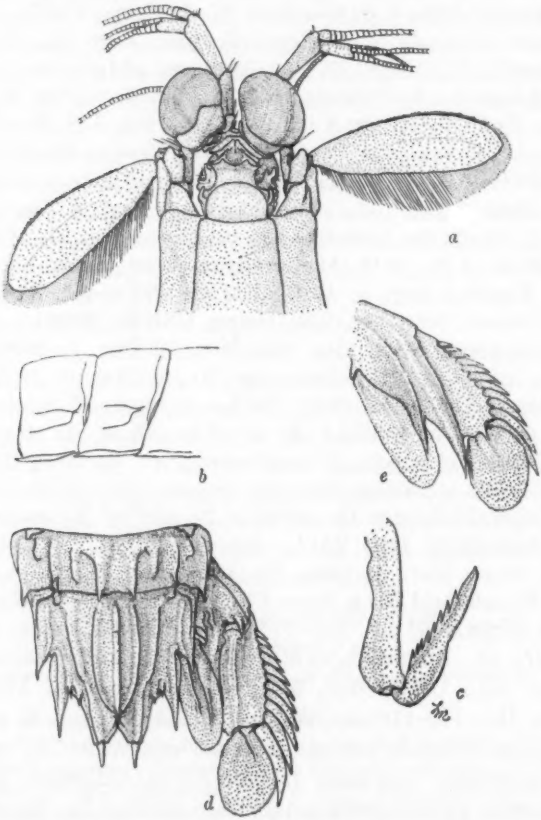


FIGURE 6.—*Odontodactylus brevirostris* (Miers), male, TL 56.9 mm, Hawaii: *a*, anterior portion of body; *b*, third to fifth abdominal somites, in lateral view; *c*, propodus and dactylus of raptorial claw; *d*, sixth abdominal somite, telson, and uropod; *e*, uropod, ventral view (setae omitted in *d*, *e*).

carapace; margin almost completely setose, proximal fourth of anterior margin not setose, anterior setae much smaller than posterior.

Rostral plate short, evenly rounded; plate in juvenile specimens trapezoidal or rounded, apex slightly deflexed.

Dactylus of raptorial claw with 6–10 teeth.

Second to fifth abdominal somites each with anterolateral pit from which a shallow groove extends posteriorly; grooves increasing in depth posteriorly, on fourth somite flanked by low carina, flanking carina of fifth somite more prominent; sixth somite with 6 pairs of sharp posterior spines, submedians each with posteriorly reflected portion lying between submedian and intermediate carinae; sixth somite with large anterior tubercle between intermediate and lateral carinae; third to fifth abdominal somites with posterolateral spines; sixth somite without ventrolateral spines in front of articulation of uropod.

Telson broader than long, with 1 pair of accessory median carinae; submedians long, occasionally suppressed at base of submedian tooth; intermediate denticles with short dorsal carina; carina of intermediate tooth not extending anteriorly much past base of tooth; lateral carinae subparallel or convergent with marginal, if subparallel apex occasionally turning toward and fusing with apex of marginal carina on lateral tooth; anterior surface of telson with distinct tubercle lateral to submedian carina.

Outer margin of proximal segment of uropod exopod with 8–11 movable spines, not markedly spatulate or upturned, last not extending to end of distal segment; distal segment of uropod about four-fifths as long as proximal, relative lengths of the segments varying; outer spine of basal prolongation the longer.

Color.—Faded in most specimens except for a dark spot on the proximal segment of the uropodal exopod. One specimen had short, interrupted lines on the dorsum of the body and dark posterolateral patches on the carapace in addition to the spots on the uropods.

Size.—Males, TL 13.0–56.9 mm; females, 13.7–79.4 mm.

Measurements and indices for selected specimens of *O. brevirostris* (Miers) are as follows:

	Females							
Total length	26.2	30.5	32.7	36.6	53.4	61.5	55.2	79.4
Carapace length	5.8	7.5	7.8	8.8	11.9	12.9	13.0	17.8
Cornea length	1.8	2.4	2.5	3.2	3.3	3.5	3.4	4.0
Cornea width	2.1	2.1	2.5	3.7	3.2	3.7	3.1	4.1
Antennal scale length	3.2	4.9	5.3	–	–	–	–	–
Fifth abdominal somite width	5.3	6.8	8.0	9.1	12.6	13.0	12.5	17.2
Telson length	4.7	3.9	5.1	5.6	8.4	9.8	8.9	12.7
Telson width	4.0	5.4	6.5	7.3	10.1	10.2	10.6	13.8
CI	276	357	312	238	372	349	419	434
AWCLI	913	906	1025	1034	1058	1007	961	966
Uropod P/D	2.00	1.14	1.52	1.61	1.02	1.68	1.25	–

	Males				
Total length	25.5	25.4	31.7	50.4	56.9
Carapace length	5.2	5.5	6.8	10.9	11.7
Cornea length	2.0	2.3	2.5	3.5	3.8
Cornea width	1.8	1.9	2.4	4.0	4.5
Antennal scale length	4.0	–	4.8	–	10.6
Fifth abdominal somite width	5.3	5.5	6.5	10.9	11.8
Telson length	3.2	3.8	4.6	7.3	8.7
Telson width	4.4	4.5	5.5	8.5	9.2
CI	289	289	283	272	260
AWCLI	1019	1000	955	1000	1008
Uropod P/D	1.24	1.21	1.25	1.12	1.13

DISCUSSION.—The presence of ocular scales separated by a deep pit, more than five teeth on the raptorial claw, and only one pair of accessory median carinae on the telson will distinguish *O. brevirostris* from all other species in the genus. The ocular scales and characteristic intervening pit are visible even in first stage postlarvae.

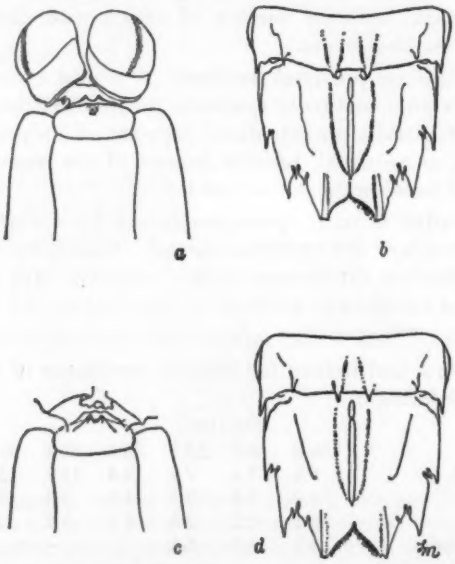


FIGURE 7.—*Odontodactylus brevirostris* (Miers). Female, TL 26.9 mm, Hawaii: *a*, outline of front; *b*, outline of sixth abdominal somite and telson. Male, TL 26.5 mm, Hawaii: *c*, outline of front to show ocular scales; *d*, outline of last abdominal somite and telson.

It is with some hesitation that I use the name "*brevirostris*" for this species. The type of *O. brevirostris* is a young male with only submedian carinae on the telson, but the ocular scales are clearly separated

by a pit and the claw has nine teeth. No differences could be found between it and specimens of similar size from the Indo-West Pacific. A western Atlantic specimen compared with the type is smaller but apparently identical.

O. brevirostris has a comparatively larger eye at any size than any other species of the genus. Kemp (1911, 1913) commented upon the large size of the eyes in his specimens of *O. southwelli*.

Juveniles of *O. brevirostris*, TL 13–30 mm (fig. 7), may not have the full complement of carinae on the last abdominal somite and telson. The carinae may be present in specimens as small as TL 16–20 mm (fig. 8) and absent in specimens as large as TL 27 mm.

Five specimens of large postlarvae have been examined. Data on postlarvae and juveniles are summarized as follows:

1. Small postlarvae (telson with median and submedian carinae only):

TL 13.0 mm	Bahamas	USNM	♀?
TL 13.0 mm	Celebes	RMNH	♂
TL 13.7	[Indo-Malaya]	ZMA	♀?
TL 13.8	Ceylon	BMNH	♀?

2. Large postlarvae (as above but of larger size):

TL 23.3	Providence Is.	type of *G. brevirostris*	♂
TL 26.2	Seychelles	UMZ	♀?
TL 26.5	Hawaii	USNM	♂
TL 26.7	Hawaii	USNM	♀?
TL 26.9	Hawaii	USNM	♀?

3. Juveniles (telson with full complement of carinae):

TL 16.0	New Guinea	ZMA	♂
TL 16.1	Philippines	ZMA	♂
TL 17.2	Amirantes Ils.	syntype of *O. latirostris*	♀?
TL 20.0	Cuba	type of *G. havanensis*	♂
TL 25.4	Celebes	USNM	♂
TL 25.5	Banda	ZMA	♂

All larger specimens have the telson provided with the normal complement of carinae.

The small and large postlarvae appear to be identical except for size. All large postlarvae are from Indo-West Pacific whereas small postlarvae and small juveniles may occur in both the Atlantic and the Indo-West Pacific.

There are several possible explanations for the differences in size of the postlarvae. The term "postlarva" is used for young specimens at the first intermolt state after the last pelagic larval stage. In *Alima hyalina* (see Manning, 1962) the postlarva is a distinct, benthic stage intermediate between the last larva and the first-stage juvenile. *Alima* has but one postlarval stage; with the next molt it assumes features that are more characteristic of the adult. In *Odontodactylus*

there may be more than one postlarval stage during which the animal increases in size but does not develop the characteristic telson morphology of the adult, although this seems unlikely. In *Alima hyalina* the last larval stage is almost twice as long as the postlarva; *Odontodactylus* may have a larger postlarva than juvenile. Under certain conditions *Odontodactylus* may also have some mechanism of prolonging the larval stage so that postlarvae may be of different size. Finally,

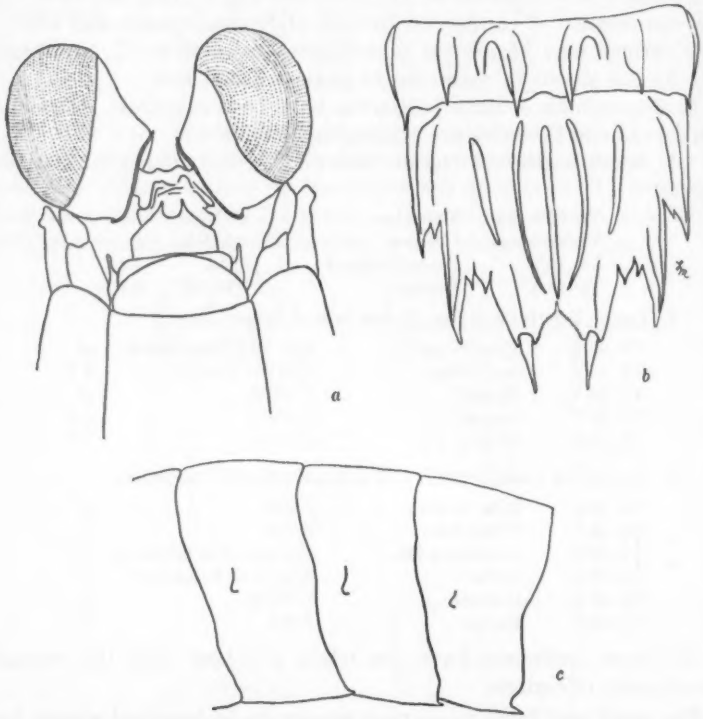


FIGURE 8.—*Odontodactylus brevirostris* (Miers), holotype of *Gonodactylus havanensis* Bigelow, male, TL 20.0 mm, off Havana: *a*, front; *b*, sixth abdominal somite and telson; *c*, third to fifth abdominal somites in lateral view.

there may be more than one species involved and two or more species may be represented in the available material. Until more is known about the ontogenetic changes in *Odontodactylus*, the specimens of that genus, with the widely separate ocular scales, more than five teeth on the claw, and one pair of accessory median carinae on the telson, should be referred to *O. brevirostris*.

A similar disparity of size in postlarvae has been observed in young specimens of *O. scyllarus*.

Juveniles of *O. brevirostris* may also differ from adults in having the rostral plate trapezoidal in shape rather than semicircular; however, the latter shape is more usual.

I have been unable to detect any differences between adult specimens (TL 40 mm or more) from the western Atlantic and the Indo-West Pacific. The type of *Gonodactyus havanensis*, a male, TL 20.0 mm, is illustrated in outline in figure 8. As in most small specimens of similar size from the Indo-West Pacific, the carinae of the telson are relatively well developed. The western Atlantic *O. nigricaudatus* cannot be distinguished from specimens of similar size from the Indo-West Pacific, and it, too, must be considered a synonym of *O. brevirostris*. A more detailed account of the western Atlantic specimens is in press.

In *O. brevirostris* the carina of the lateral tooth may lie parallel with the margin, it may converge distally with the marginal carina, or it may lie parallel except for its extremity, which turns and fuses with the marginal carina. The position of the carina is very variable, as noted by Bigelow (1931) in specimens from Hawaii.

DISTRIBUTION.—Western Atlantic and Indo-West Pacific, from the western Indian Ocean through Indo-Malaya to Hawaii; in moderate depth, to 424 m. This species lives at greater depths than any other in the genus.

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